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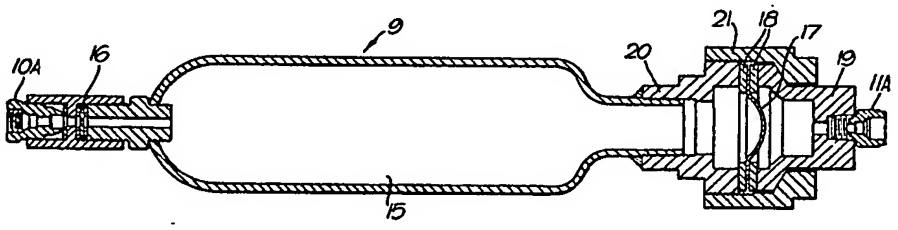
(54) Fluid pressure controlled time delay apparatus and system, and fire fighting installation incorporating such system.

(57) A time delay device, particularly for use with CO_2 or other fire fighting installations, to introduce a predetermined delay for evacuation etc between the raising of alarm and the discharge f the fire fighting medium. The device comprises a chamber 15 with an inlet controlled by a restricted orifice 16 and an outlet controlled by a bursting disc 17. When the alarm is raised high pressure gas is supplied to the inlet 10A and metered through the orifice 16 into the chamber 15 until the pressure in the chamber causes the disc 17 to rupture, the time taken for rupture depending on the size of the orifice 16, the capacity of the chamber 15 and the bursting pressure of the disc 17. When the disc ruptures a surge of pressurised gas passes through the outlet 11A to a pneumatic relay (not shown) to cause release of the fire fighting medium.



EP 0 046 378 A2

Fluid pressure controlled time delay appratus and system, and fire fighting installation incorporating such system

The present invention relates to fluid pressure controlled time delay apparatus and is particularly, though not exclusively, concerned with time delay apparatus for use in connection with fire fighting systems of the type frequently installed e.g. in commercial and industrial premises for releasing a fluid fire extinguishing/prevention medium, such as carbon dioxide vapour, into the environment in the event or threatened event of fire.

In fire fighting installations of this type it is customary to employ a device which introduces a predetermined time delay between the initiation of a fluid-releasing sequence and the actual discharge of the medium into the environment. This is in order to permit personnel to

evacuate before there is any risk of the environment being rendered irrespirable or otherwise harmful by the medium itself. It is furthermore advisable to delay the discharge of the medium until sufficient time has elapsed for fire doors to be closed, ventilators to be shut down etc, in order to maximise the effects of the medium when discharged. The typical time delays provided by these devices range from a few seconds to about a minute.

It is preferable, for reliability, that the operation of the time delay apparatus is independent of external electricity or other power supplies and hence various types of device have been proposed hitherto which rely for their operation on a source of stored fluid pressure. Such devices, as exemplified eg by United States Patent Specifications Nos. 2537009, 2663153, 2819865 and 2865592, typically comprise a chamber of predetermined volume into which the pressurised fluid is metered through a restricted flowpath provided eg by an orifice or capillary tube. The pressure within the chamber is applied to one side of a piston exposed on its other side to a reference pressure, and the piston controls a valve which, when opened, connects the primary pressure source directly to some pressure-responsive means for releasing the fire fighting medium. Initiation of the release sequence is accomplished by establishing communication between the pressure source and the chamber, but actual discharge of the fire fighting medium does not occur until the pressure in the chamber has risen to a value sufficient to move the piston and open the associated valve, and with a given source pressure the time taken to reach any selected pressure in the chamber depends upon

the capacity of the chamber and the characteristics of the restricted flowpath by which it is connected to the pressure source.

Time delay devices as described above are relatively complex and the parts of the piston/valve assembly need to be made to close tolerances; hence they are expensive to produce. The present invention seeks to provide fluid pressure controlled time delay apparatus suitable for the same service as described above but being significantly simplified in its construction and operation, and hence amenable to more economical production.

In a first aspect the invention accordingly resides in time delay apparatus comprising a chamber of predetermined volume; a restricted flowpath for communicating a source of pressurised fluid with said chamber; and an outlet from the chamber normally closed by a bursting disc.

By a "bursting disc" is meant an element which is adapted to rupture to open the said outlet to the transmission of fluid pressure from the chamber when a predetermined pressure differential across the element is established. In use, with a reference pressure on the downstream side of the disc, the time taken to establish a selected burst pressure differential will depend upon the source pressure, the capacity of the chamber and the characteristics of the restricted flowpath, as in the case of the prior art devices referred to above. However, on rupture of the disc the resultant surge of pressure from the chamber can be used directly through suitable pressure-responsive means to release a fire fighting medium or perform other functions in other applications of the device, so that the need for a piston/valve assembly in the delay apparatus can be eliminated. This leads not only to a simplification in the construction of the time delay apparatus but also to a simplification in, and

consequently a potential increase in the reliability of, the operation of the apparatus, no moving parts being required. Furthermore, with a given source pressure, chamber capacity and restricted flowpath characteristics, selection of different time delays can be very simply and effectively achieved by the substitution of bursting discs with different burst pressures.

In a second aspect the invention resides in a time delay system comprising a source of pressurised fluid; a chamber of predetermined volume; a restricted flowpath for communicating said source of pressurised fluid with said chamber; an outlet from the chamber normally closed by a bursting disc; first means operable to establish communication between said source and chamber through said flowpath; and second means for performing a function in response to the transmission of fluid pressure from said chamber upon rupture of said bursting disc.

Such a system will involve a time delay between the operation of the first means and the response of the second means determined by the time taken for the pressure within the chamber to rise to a value which causes rupture of the bursting disc, as previously described. When such a system is incorporated in a fire fighting installation of the type discussed the operation of the first means - which may comprise e.g. a valve or piercer mechanism associated with the pressure source - may be effected automatically or manually in response to the automatic detection of a fire or otherwise upon the raising of alarm, the second means comprising a mechanism operable to release the fire fighting medium upon the transmission of fluid pressure from the aforesaid chamber. However, apparatus and systems according to the invention are of general utility in the provision of selected time delays between a first event and a second event conditional upon the first, and are not restricted to the field of fire fighting.

The invention will now be more particularly described, by way of example, in the context of an application to a fire fighting installation, reference being made to the accompanying drawings

in which:

Figure 1 is a schematic diagram of the installation; and

Figure 2 is a more detailed sectional view, to an enlarged scale, of the time delay device incorporated in the installation of Figure 1.

Referring to the drawings, the installation comprises a source of fluid fire fighting medium illustrated as a bank of cylinders 1 of compressed CO_2, each of which is communicable through an individual knuckle valve 2 with a manifold 3 by which the gas is distributed to the areas to be protected in the event or threat of fire. Operation of the valves 2 to release the stored gas can be effected by a pneumatic relay 4 having a piston 5 which, when pressure is transmitted to the cylinder of the relay, moves to withdraw a connecting cable 7 to which the valves 2 are all linked.

The power for operating the relay 4 is derived from a cylinder 8 of compressed inert gas, such as nitrogen. On the raising of alarm the cylinder 8 is opened to supply gas to a delay device 9 interposed in the line 10/11 between the cylinder 8 and relay 4, in the illustrated embodiment the outlet from the cylinder 8 being equipped with a frangible closure 12 which can be pierced by a pin 13 connected to a hand lever 14 to place the cylinder in communication with the delay device.

The delay device 9, which is more clearly shown in Figure 2, comprises a pressure vessel 15 having an inlet fitting which includes a restricted orifice 16 and an inlet adaptor 10A for connection to the line 10. The vessel 15 is also equipped with an outlet fitting which includes a bursting

disc 17 and an outlet adaptor 11A for connection to the line 11. In use, when the cylinder 8 is opened nitrogen gas passes through the line 10, adaptor 10A and orifice 16 into the chamber defined within the vessel 15, but is initially prevented from reaching the relay 4 by the bursting disc 17. Pressure builds up within the vessel 15 at a rate determined by its capacity and the size of the orifice 16, until after a certain interval the pressure differential across the disc 17 (its downstream side being exposed to the ambient pressure in the relay cylinder 6 and line 11 at this time), reaches the value which causes the disc to rupture. When this occurs a surge of pressurised nitrogen passes from the vessel 15 through the adaptor 11A and line 11 to the relay cylinder 6 to move the piston 5 and thereby release the fire fighting medium from the cylinders 1.

For a given source pressure the time delay introduced by the device 9 between operation of the lever 14 and the release of the fire fighting medium depends upon the capacity of the vessel 15, the size of the orifice 16 and the burst pressure of the disc 17. Variation of the delay can be achieved by changing the effective capacity of the vessel 15 or the size of the orifice 16, but most simply and effectively can be achieved by substituting discs 17 with different burst pressures. The discs are typically made from nickel-silver or copper, discs of this type being commercially available and reliably adapted to rupture at pressures within closely prescribed limits. In one example of a delay device constructed as illustrated in which the capacity of the vessel 15 is approximately 230ccs and the diameter of the orifice is 0.015" (0.38mm), and working from a 1400 psi (97 bar) pressure source, a disc 17 with a burst pressure of 600 psi (41 bar) gives a delay of 7 seconds while a disc with a burst

pressure of 700 psi (48 bar) gives a delay of 21 seconds. As shown in Figure 2, the disc 17 is clamped peripherally between a pair of washers 18 which in turn are clamped between a cone ring 19 and a seating ring 20 provided on the vessel 15, the assembly being secured by a locking ring 21 screwed onto the ring 20 and retaining the ring 19. To change the disc 17 the locking ring 21 is simply unscrewed to permit the rings and washers to be separated.

It will be appreciated that the details given above of the means by which pressurised fluid is made available to the delay device 9, and of the means which respond to the rupture of the disc 17 and the functions performed thereby, are given for the purposes of illustration only and are capable of considerable variation without changing the essential construction and operation of the delay device itself.

CLAIMS

1. A fluid pressure controlled time delay apparatus comprising a chamber (15) of predetermined volume, a restricted flowpath (10,16) for communicating a source (8) of pressurised fluid with said chamber (15), and means (17) normally closing an outlet (11A) from the chamber (15); characterised in that said closing means comprises a bursting disc (17).

2. A fluid pressure controlled time delay system comprising a source (8) of pressurised fluid, a chamber (15) of predetermined volume, a restricted flowpath (10,16) for communicating said source (8) of pressurised fluid with said chamber (15), means (17) normally closing an outlet (11A) from the chamber (15), first means (13,14) operable to establish communication between said source (8) and chamber (15) through said flowpath (10,16), and second means (4) for performing a function in response to the transmission thereto of fluid pressure; characterised in that said closing means comprises a bursting disc (17) and said second means (4) is arranged to perform its said function in response to the transmission thereto of fluid pressure from said chamber (15) upon rupture of said bursting disc (17).

3. A time delay apparatus or system according to claim 1 or claim 2 characterised in that said flowpath (10) is restricted by means of an orifice (16) of predetermined cross-sectional area at the inlet (10A) of said chamber (15).

4. A time delay apparatus or system according to any one of claims 1 to 3 characterised in that said bursting disc (17) is mounted to close said outlet (11A) by being

clamped at its periphery between a pair of ring members (19,20) associated with said chamber (15) and secured together in demountable fashion.

5. A fire fighting installation incorporating a time delay system according to claim 2 or to either of claims 3 and 4 when appended thereto, characterised in that said second means (4) comprises a mechanism arranged to release a fire fighting medium (1) in response to the transmission thereto of fluid pressure from said chamber (15) upon rupture of said bursting disc (17).

6. A fire fighting installation according to claim 5 characterised in that said first means are arranged to operate in response to a signal from automatic fire detection means.

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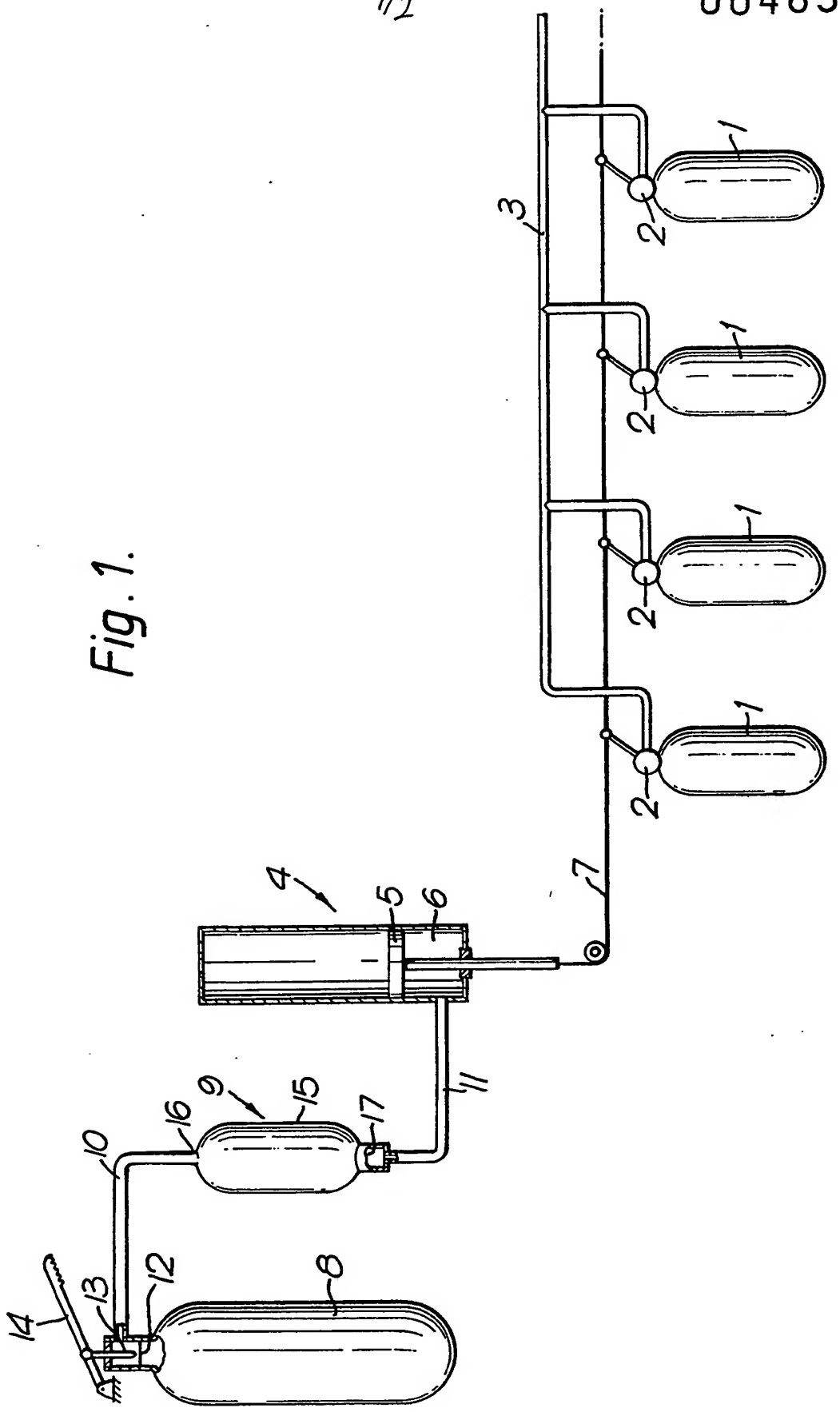

Fig. 1.

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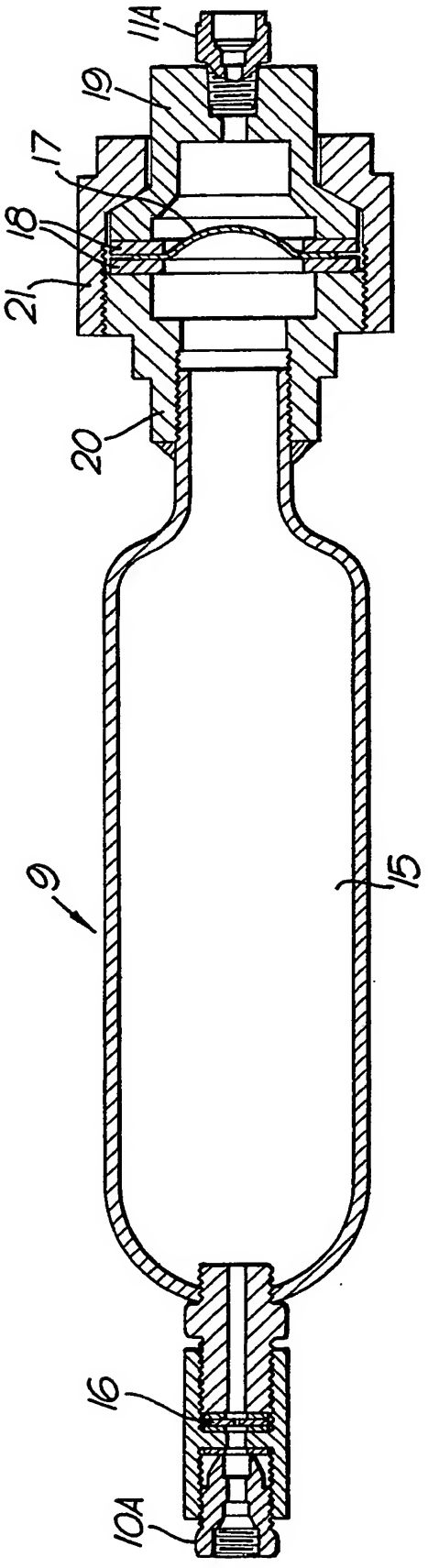

Fig. 2.